

UNITED STATES MARINE CORPS
Logistics Operations School
Marine Corps Combat Service Support Schools
Training Command
PSC Box 20041
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AOM 6702

STUDENT OUTLINE

**REPLACE THE HMMWVA2 ENGINE,
TRANSMISSION, AND TRANSFER ASSEMBLIES.**

LEARNING OBJECTIVES

1. Terminal Learning Objectives:

(a) Given a HMMWVA2, TM 9-2320-280-10, TM 9-2320-280-20-1, TM 9-2320-280-20-2, TM 9-2320-280-20-3, TM 9-2320-280-34, required tools, shop supplies, equipment, repair parts, and consumables, replace the engine assembly, per information contained in the references. (6.7.1)

(b) Given a HMMWVA2, TM 9-2320-280-20-1, TM 9-2320-280-20-2, TM 9-2320-280-20-3, TM 9-2320-280-34, required tools, shop supplies, equipment, repair parts, and consumables, replace the transmission/ transfer assembly, per information contained in the references. (6.7.2)

2. Enabling Learning Objectives:

(a) Given a HMMWVA2, TM 9-2320-280-10, TM 9-2320-280-20-1, TM 9-2320-280-20-2, TM 9-2320-280-20-3, TM 9-2320-280-34, required tools, shop supplies, equipment, repair parts, and consumables, per information contained in the references:

(1) remove engine assembly from vehicle, (6.7.1a)

(2) install engine assembly into vehicle, and (6.7.1b)

(3) perform run-in procedures on engine assembly.
(6.7.1c)

(b) Given a HMMWVA2, TM 9-2320-280-20-1, TM 9-2320-280-20-2, TM 9-2320-280-20-3, TM 9-2320-280-34, required tools, shop

supplies, equipment, repair parts, and consumables, per information contained in the references:

- (1) remove transmission/transfer assembly from vehicle,
(6.7.2a)
- (2) install transmission/transfer assembly in vehicle,
and (6.7.2b)
- (3) check for proper transmission/transfer assembly
operation. (6.7.2c)

OUTLINE

1. SAFETY PRECAUTIONS FOR REPLACEMENT OF MAJOR COMPONENTS

a. During the hoisting and lowering operations, make sure there are no obstructions on the vehicle and shop floor. All personnel not involved should stand clear. The team leader, with the guidance of the instructor assigned to your team, will direct all hoisting and lowering operations.

b. When hoisting and lowering operations are in progress, never allow any part of your body underneath the lift. If a component is restricted from clearing the vehicle, lower the assembly and clear the obstruction. Do not force hoisting or lowering operations.

c. When working under a vehicle always wear eye protection to prevent fluids, lubricants or dirt from entering your eyes and causing injury.

2. REMOVE THE ENGINE ASSEMBLY

a. Preparation for Engine Removal

(1) Raise the hood, remove the surge tank filler cap, open the radiator drain cock and allow the engine coolant to drain into the container provided.

(2) Place the transmission in the neutral position.

(3) Set the handbrake.

(4) Disconnect the battery ground cable.

(5) Disconnect the hood harness from the connector receptacle.

(6) Remove the engine hood.

(7) Raise and support the vehicle.

(a) Place the jack under the lower control arm on the corner of the vehicle to be raised.

(b) Raise the vehicle high enough to place the trestle under the flat portion of the frame rail and lower the jack until the weight of the vehicle is supported by the trestle.

(c) Repeat the steps on all corners of the vehicle until the weight of the vehicle is supported by the four trestles.

(7) Remove splash shields.

(a) Remove the nuts, washers and capscrews securing the splash shields to the support brackets and air lift brackets.

(b) Remove the left and right splash shields.

(c) Place the splash shields in the rear of the vehicle and the fastening hardware in the container provided.

(8) After the vehicle has been prepared for engine removal, a team system will be used to remove the engine as efficiently as possible. One member of the team will be assigned as the team leader. The leader is responsible for making sure that each member of the team is assigned to perform certain tasks. Team leader should also make sure each member of the team knows how to perform each procedure. Team leaders are responsible for notifying the instructor that they have completed a specific task and are ready to proceed to the next step in removing the engine assembly. The team leader will also be responsible for inventory of all special tools, shop equipment, shop supplies and repair parts.

(9) As each line or electrical lead is disconnected, tag the item to identify its location. All lines will be capped to prevent dirt from entering. After a component has been removed or disconnected, all mounting hardware (nuts and bolts) will be

placed in the container provided. Make sure all hoses, lines, wires and linkages are fastened clear of the engine to avoid "hang ups" or "snagging" during removal which may cause equipment damage or personal injury.

b. Engine Removal

(1) Disconnect the engine oil cooler supply and return lines from the engine oil cooler ports.

(2) Disconnect the transmission oil cooler line connector hoses from the transmission oil cooler ports.

(3) To prevent equipment damage we will remove the oil cooler, radiator and fan shroud as a unit. The procedures are as follows:

(a) remove the radiator inlet hose from the radiator.

(b) remove the surge tank-to-radiator hose from the radiator.

(c) disconnect the controlled vent hose from the shroud bulkhead adapter,

(d) disconnect the fan drive hose from the fan drive,

(e) remove the lower radiator hose from the radiator,

(f) remove the lower radiator mount,

(g) remove the two rear radiator supporting brackets,

(h) remove the radiator and shroud and place them in the rear of the vehicle.

(4) The fan blade is removed next.

(a) Note the position of the fan and place a chalk mark on the fan for installation.

(b) Remove the four nuts securing the fan blade to the fan drive remove the fan blade.

(5) Remove the air horn and air horn elbow, tape up the intake manifold to avoid dropping small items in the engine.

(6) Disconnect the multiple connector and remove the glow plug controller.

(7) Remove the CDR valve manifold hose and disconnect the CDR valve oil fill tube hose.

(8) Remove the surge tank hose from the water crossover.

(9) Disconnect the heater hose from the water crossover and water pump.

(10) Disconnect the fuel return hose from the return line and the fuel supply and vent lines from the fuel pump.

(11) Disconnect the water pump inlet hose from the water pump.

(12) Disconnect the throttle return spring and cable assembly from the injection pump bracket.

(13) Remove the throttle cable stop collar and disconnect the cable from the throttle shift lever bracket.

(14) Disconnect the fuel inlet and outlet lines from the fuel filter.

(15) Disconnect the engine harness connector from the time delay module and protective control box.

(16) Remove the clamps securing the engine harness to the A frame and body.

(17) Disconnect the two return lines and high pressure line from the power booster.

(18) Loosen and remove the two alternator drive belts.

(19) Disconnect the spring clip from the modulator line and remove the modulator cable.

(20) Disconnect lead 36A from the oil pressure sending unit and engine harness leads 33B and 58A from the body harness leads.

(21) Disconnect the oil cooler supply and return lines from the engine.

(22) Remove the clamp securing the STE/ICE harness to the transmission and disconnect the harness connector from the rpm sensor.

(23) Remove the clamp securing the kick-down switch connector to lead 315C on the transmission.

(24) Remove ground leads 3A and 58A to the cylinder head.

(25) Disconnect transmission dip stick tube from cylinder head.

(26) Remove the clamps securing lead 315C and the speedometer cable to the transmission and disconnect lead 315C from the transmission.

(27) Disconnect all starter and solenoid connections.

(28) Remove the exhaust crossover pipe and place it in the rear of the vehicle.

(29) Remove the converter housing cover.

(30) It will be necessary to rotate the flywheel clockwise to gain access to the capscrews securing the torque converter.

(a) Remove the six capscrews securing the torque converter to the flywheel.

(b) Slide the torque converter away from the flywheel and secure the converter to the transmission with wire to prevent it from falling.

(31) Position the engine lifting sling bracket on the engine and secure it to the front right cylinder head with two bolts.

(32) Install the sling bracket on the rear left cylinder head and secure it with two bolts.

(33) Secure the sling bracket to the lifting sling with the pin provided

(34) Connect the engine hoist to the center hook on the engine sling, raise the engine only enough to take pressure off the mounting brackets.

(35) Remove the front propeller shaft.

(a) Remove the capscrews and bearing straps securing the front propeller shaft to the differential pinion yoke and the transfer case output yoke.

(b) Tape the bearing caps together to prevent the loss of the bearings.

(c) Remove the locknuts, washers and capscrews securing the center bearing to the engine mount.

(d) Tape the bearing caps together to prevent the loss of the bearings.

(e) Move the propeller shaft forward, then rearward over the top of the transfer case.

(f) Remove the propeller shaft and place it in the rear of the vehicle.

(36) Support the transmission with the transmission jack and secure the jack to the transmission. Place a safety chain under the transmission oil cooler and speedometer cable and connect the safety chain to the transmission jack.

(37) Remove the nuts and washers securing the engine mount insulators to the frame brackets.

(38) Remove bellhousing bolts.

(39) To prevent injury, direct all personnel not

participating in engine removal to stand clear during the hoisting operation.

(40) Raise the engine slowly and watch for engine binding. Make sure the wiring, lines, cables and rods are not in the path of removal.

(41) When the engine is clear of the vehicle, move the chain hoist forward and lower the engine onto the engine stand.

3. REMOVE THE TRANSMISSION/TRANSFER ASSEMBLY

a. Preparation for Transmission/Transfer Removal

(1) Remove rear propeller shaft.

(a) Remove the nuts, lockwashers and U-bolts securing the propeller shaft to the transfer case output yoke.

(b) Remove the capscrews and lockwashers securing the propeller shaft to the parking brake rotor.

(c) Remove the propeller shaft and place it in the rear of the vehicle.

(2) Disconnect the transmission shift rod.

(a) Remove the cotter pin and washer securing the shift rod trunnion to the shift lever and disconnect the shift rod.

(b) Tape the trunnion to the shift rod to retain the proper adjustment.

b. Remove the Transmission/Transfer Assembly

(1) Disconnect the two hoses from the cooler lines and allow the fluid to drain into the container provided.

(2) Disconnect the main vent line from the transmission and transfer case vent line.

(3) Remove the speedometer cable and adapter from the transfer case.

(4) Make sure the weight of the transmission and transfer assembly is still supported by the transmission jack.

(5) Remove the transmission mount crossmember.

(6) Slowly lower the transmission jack, making sure wiring, lines, cables, and rods are not in the path of transmission and transfer removal.

4. SEPARATE AND CONNECT THE TRANSFER TO THE TRANSMISSION

a. Separate the Transfer from the Transmission

(1) Disconnect the transmission/transfer case cooler lines from the transmission.

(2) Remove the vent line clamp and disconnect the transmission/transfer vent line from the transmission vent tube.

(3) Remove the locknuts securing the transmission to the transfer case adapter.

(4) Being careful not to damage the aluminum housing, separate the transmission from the transfer case adapter.

(5) Clean the old sealer from the transfer case adapter and transmission mounting surface with a putty knife.

b. Connect the Transfer to the Transmission

(1) Apply flange sealant to the transmission mounting surface.

(2) Install the transmission onto the transfer case adapter and torque the locknuts to thirty-seven foot-pounds.

(3) Connect the transmission/transfer vent lines to the transmission vent tube and install the vent line clamp.

(4) Connect the transmission/transfer case cooler lines to the transmission.

5. INSTALL THE TRANSMISSION AND TRANSFER ASSEMBLY

a. Procedures for Installing the Transmission and Transfer Assembly

(1) Position the transmission and transfer assembly under the vehicle.

(2) Slowly raise the transmission jack making sure that wiring, lines, cables, and rods are not in the way of transmission and transfer installation.

(3) Install the transmission mount cross member.

(4) Install the speedometer cable and adapter.

(5) Connect the main vent line to the transmission and transfer case vent line.

(6) Connect the two hoses to the cooler lines.

(7) Remove the tape from the trunnion on the transmission shift rod.

(8) Connect the transmission shift rod to the transmission shift lever and secure it with a washer and cotter pin.

(9) Install the rear propeller shaft to the transfer case output yoke and secure it with U-bolts, lockwashers, and nuts.

6. INSTALL THE ENGINE ASSEMBLY

a. Procedures for Installing the Engine Assembly

(1) Raise the engine from the stand and move the chain hoist over the engine compartment. Slowly lower the engine into the vehicle while watching for engine binding. Make sure that the wiring, lines, cables, and rods are not in the path of installation. Aline the right and left engine mount insulators to the frame bracket.

(2) Remove safety wire and install the capscrews and studs securing the transmission to the engine. Torque the capscrews and studs to specifications.

(3) Install the washers and locknuts.

(4) Remove chain securing transmission jack to transmission remove jack.

(5) Remove the tape from the bearing caps of the front propeller shaft.

(6) Install the bearing straps and connect the front propeller shaft to the transfer case output yoke and the differential yoke with capscrews.

(7) Remove the pin securing the sling bracket to the engine lifting sling.

(8) Remove the bolts securing the sling bracket to the engine lifting sling.

(9) Remove the bolts securing the sling bracket and engine lifting sling to the cylinder heads and remove the engine lifting sling from the engine.

(10) Aline the torque converter to the flywheel by rotating the flywheel in a clockwise direction.

(11) Install the capscrews securing the torque converter to the flywheel and install the converter housing cover.

(12) Install the exhaust crossover pipe.

(13) Connect leads 74A and 74B to the solenoid and secure with a clip and screw.

(14) Connect positive cable 6A, lead 81A, and lead 81B to the starter.

(15) Install the clamps on cables 6A and 7A.

(16) Connect lead 315C and the speedometer cable to the transmission and the harness connector to the rpm sensor.

(17) Connect the engine harness leads to the body harness leads and connect lead 36A to the oil pressure sending unit.

(18) Connect the oil cooler supply line and oil cooler return line to the engine.

(19) Install the modulator cable.

(20) Connect the transmission dipstick tube to cylinder head.

(21) Install and adjust the drive belts.

(22) Connect the return lines and high pressure line to the power steering pump.

(23) Connect the fuel inlet and fuel outlet lines to the fuel filter.

(24) Connect the engine harness connector to the time delay module and connect the harness connector plug to the protective control box.

(25) Secure the engine harness to the body and "A" beam.

(26) Install the cable assembly on the throttle shaft bracket and connect the throttle return spring.

(27) Connect the water pump inlet hose to the water pump.

(28) Connect the vent line and fuel supply line to the fuel pump.

(29) Connect heater hose to the water crossover and water pump.

(30) Connect hose from surge tank to water cross over.

(31) Connect the vent lines and hose from oil filler tube to CDR valve.

(32) Install the glow plug controller.

(33) Install the air horn and air horn elbow.

(34) Install the fan blade.

(35) Install the radiator.

(36) Install the radiator rear support brackets.

(37) Install the radiator front support bracket.

- (38) Install the lower radiator hose.
- (39) Connect fan drive hose.
- (40) Connect hose from fan drive solenoid to fan shroud.
- (41) Connect the hose from surge tank to radiator.
- (42) Install radiator inlet hose.
- (43) Connect the transmission oil cooler line hoses to the oil cooler ports.
- (44) Connect the engine oil cooler supply and return lines to the engine oil cooler ports.
- (45) Replenish engine oil and transmission fluid to the proper level.
- (46) Replenish engine coolant to the proper level.
- (47) Bleed fuel system.
- (48) Start the engine and run at an idle for five to ten minutes. Stop the engine and inspect engine oil level, transmission fluid level and engine coolant level.
- (49) Check for leaks and correct as necessary.
- (50) Apply the service brake pedal and shift the transmission through all operating ranges checking for stiffness or binding in the transmission selector lever and unusual noises or vibrations from the transmission.
- (51) Apply the service brake pedal and place the transmission selector lever in the neutral position. Shift the transfer through all operating ranges. Check for stiffness or binding in the transfer shift lever and unusual noises or vibrations from the transfer.
- (52) Install splash shields.
- (53) Raise the vehicle, remove the trestles and lower the vehicle.
- (54) Install hood support rod and hood.

(55) Connect the hood wiring harness.

(56) Start the engine and run at 1/4 to 1/2 engine throttle until the coolant temperature reaches 165 to 190 degrees Fahrenheit.

(57) Check for leaks and fluid levels, take on road test.

REFERENCES:

TM 9-2320-280-10

TM 9-2320-280-20-1

TM 9-2320-280-20-2

TM 9-2320-280-20-3

TM 9-2320-280-34